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Koghut, Maksym, Al-Tabbaa, Omar, Lee, Soo Hee and Meyer, Martin (2023) Technology-based inter-organisational relationships: new insights for social and innovation implications. In: UK Academy of Information Systems (UKAIS) 2023 Conference, 20 April 2023 - 21 April 2023, Kent, UK.

Publisher: UK Academy of Information Systems (UKAIS)

Version: Accepted Version

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Additional Information: This is an accepted manuscript of a paper first presented at UK Academy of Information Systems (UKAIS) 2023 Conference

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TECHNOLOGY-BASED INTER-ORGANISATIONAL RELATIONSHIPS: NEW INSIGHTS FOR SOCIAL AND INNOVATION IMPLICATIONS

Abstract

This research expands theoretical and empirical understanding about the social and innovation implications of smart contracting on inter-organisational relationships. Smart contracting is a digital agreement recorded on blockchain and able to autonomously execute actions when encoded conditions are satisfied. Using the social capital perspective, authors analysed insights collected from field experts and executives of firms that either use this technology or facilitate its implementation. The findings revealed that smart contracting directly affects the formation and structure of inter-organisational social capital, which can subsequently contribute to innovation performance. Authors developed an evidence-based model that critically integrates factors influencing the relationship between social capital and innovation performance in the smart contracting settings. Interestingly, system trust, as trust in technology, is found to be the key contextual factor, driving most aspects of technology-based inter-organisational collaborations. The research advances our understanding of how inter-organisational relationships can evolve in the technology-based settings.

Keywords: Blockchain, Smart contract, Inter-organisational relationships, Social capital, Trust, Innovation

1.0 Introduction

An escalating number of scholars argue for a revision of organisation and management theories in the rise of algorithmic technologies such as artificial intelligence or blockchain (Baum & Haveman, 2020; Beyes et al., 2022; Chen et al., 2021; Kellogg et al., 2020; Lumineau et al., 2021, 2022). As these technologies increasingly mediate and ultimately impersonalise business relations, making some social interactions redundant (Lumineau et al., 2022), the leading contenders for revision are those relational theoretical perspectives in organisational discourse and practice that rest on Granovetter's (1985) now classic idea on the importance of social embeddedness. The impersonalisation issue shares some similarities with the notion of atomistic market exchanges (Williamson, 1996), where direct and social interactions between collaborating parties are not the

necessary condition for economic exchanges, and may affect the development of relational resources between firms, often conceptualised as inter-organisational social capital (Inkpen & Tsang, 2016; Kwon & Adler, 2014).

Social capital is a by-product of social interactions that provides the capacity for collective understanding and action, allowing parties to gain access to and leverage resources residing in the relationship (Adler & Kwon, 2002; Inkpen & Tsang, 2005). Pertinent literature argues that social capital positively contributes to a firm's performance, joint value creation and innovation (Autry & Griffis, 2008; Dyer et al., 2018; Tsai & Ghoshal, 1998). Its development fundamentally depends on the partners' ability to have direct, extensive, and intimate face-to-face interactions (Cousins et al., 2006). Yet, contemporary inter-organisational interactions are becoming more impersonal by way of email, text, and the Internet, but more progressively, through the automation of some workflow processes that previously involved human actors (D. Tapscott & Tapscott, 2017). Recognising this change, we not only know little about how inter-organisational social capital can change in settings where some interfirm processes are executed autonomously by digital technologies, we also lack knowledge about the concrete factors that drive this transformation.

Seeking to address this gap, our research contributes to a bourgeoning literature on the implications of digital transformation by investigating how blockchain-based smart contracting can influence interfirm social capital and the ensuing performance. Smart contracts can autonomously execute actions when encoded conditions are satisfied (Murray et al., 2021). As such, it can automate some inter-organisational business processes that previously involved human decision-makers such as managing finance (A. Tapscott & Tapscott, 2017) or supply chains (Casey & Wong, 2017; Roeck et al., 2020). Smart contracting creates a qualitatively different context (e.g., by impersonalising interactions between parties), in which the structure and development of social capital may take different forms. The resulting change may bear some important implications for organisations such as knowledge exchange and innovations (Inkpen & Tsang, 2005, 2016; P. Manning, 2010), performance (Graca et al., 2015), and ultimately competitive advantage (Dyer et al., 2018; Ireland et al., 2002). Although some theoretical arguments related to this issue emerge (Lumineau et al., 2021, 2022; Murray et al., 2020, 2021; Seidel, 2018), empirical studies on how smart contracting can affect inter-organisational relational resources and ensuing outcomes are still very limited (Batwa & Andreas, 2021; Frizzo-Barker et al., 2020; Macrinici et al., 2018; Varriale et al., 2021).

More specifically, while an emerging body of literature provides some evidence of positive associations between smart contracting and operational performance reflected in the reduction of transaction costs (S. E. Chang et al., 2019; Roeck et al., 2020), research has yet to explore how these novel, technology-based governance mechanisms can affect the development of inter-organisational relational resources such as social capital often required to produce innovation performance (Cuevas-Rodríguez et al., 2014; Nahapiet, 2009).

Focusing on this gap, we utilised the three-dimensional perspective of social capital (Nahapiet & Ghoshal, 1998) to investigate the change and outcomes of inter-organisational relationships in the smart contracting settings. Given the nascent nature of the phenomenon and the lack of related empirical literature, our methodology comprised two phases. The first was necessary to explore the phenomenon and clarify its conceptual boundaries, whereas the second phase was designed for theory building. In the first phase, we used the Delphi method (Okoli & Pawlowski, 2004) to explore the themes linking smart contracting and inter-organisational social capital. This has yielded a preliminary theoretical framework which was derived from insights collected from 28 field experts who had a practical experience with the phenomenon. In the second phase, we advanced the framework by using analytic induction (Johnson, 2004; Shi et al., 2021) applied to data collected through semi-structured elite interviews conducted with 25 executives of organisations that have either implemented smart contracting for external operations as the users of the technology, or facilitated the technology implementation as the service providers. The outcome is an evidence-based model that critically integrates factors influencing the relationship between social capital and innovation performance in the smart contracting settings.

2.0 Theoretical Background

2.1 Blockchain-based Smart Contracting

Blockchain is an Internet-based technology that can be described as a digital distributed ledger consisting of interrelated blocks of highly encrypted information that represents a record of the transactions that occur within a network (Lansiti & Lakhani, 2017). This technology, through its autonomous capabilities, can facilitate substantial improvements in contracting, enforcement, and compliance amongst partners by embedding so-called smart contracts – digital agreements whose

terms are recorded in a computer code and which can be automatically executed by the system when certain pre-defined conditions are met (Murray et al., 2021). Consequently, the implementation of such contractual advances denotes conceptually different governance mechanisms, thus changing how conventional inter-organisational processes are organised and managed. In particular, this unique technology will likely disrupt the inter-organisational processes of negotiating and contracting (Eenmaa-Dimitrieva & Schmidt-Kessen, 2019; Murray et al., 2021) as well as affect the dynamics of inter-organisational trust (Batwa & Andreas, 2021; Dubey et al., 2020; Koghut et al., 2019; Lumineau et al., 2022; Roeck et al., 2020), which all play an important role for firms' performance (see Vlaar, 2008).

Many recently published literature reviews on the blockchain phenomenon (Batwa & Andreas, 2021; Casino et al., 2019; Frizzo-Barker et al., 2020; Hawlitschek et al., 2018; Risius & Spohrer, 2017; Zhao et al., 2019) show that the main focus of the existing studies is on the economic effects (e.g., cost reduction), privacy and security issues related to the implementations of this technology, whereas limited attention has been given to the social and innovation implications of this technology. Indeed, many studies (e.g., Y. Chang et al., 2019; Liu & Zou, 2019; Mendling et al., 2018; Min, 2019; Roeck et al., 2020) focused on how blockchain technology may affect organisations, few, however, have analysed how this technology can influence social aspects of inter-organisational relationships (Batwa & Andreas, 2021; Frizzo-Barker et al., 2020; Lumineau et al., 2021, 2022; Varriale et al., 2021). Existing research generally suggests that blockchain technology (Batwa & Andreas, 2021; Y. Chang et al., 2019; Dubey et al., 2020; Hawlitschek et al., 2018; Treiblmaier, 2018; Varriale et al., 2021; Wang et al., 2019), and more specifically smart contracts (Koghut et al., 2019; Lumineau et al., 2022; Roeck et al., 2020; Ryan, 2017), influence the development of inter-organisational trust, whereas other aspects of inter-organisational relationships such as social networks, interactions, interdependence, norms, amongst other, remain overlooked. These relational aspects, often conceptualised as inter-organisational social capital (Nahapiet, 2009), are fundamental for understanding how performance can be affected by the change of governance processes brought by technological advances (Vlaar, 2008). The resulting change may bear some important implications for organisations such as knowledge exchange and innovations (Inkpen & Tsang, 2005, 2016; P. Manning, 2010), and ultimately competitive performance (Graca et al., 2015; Ireland et al., 2002). Yet, to our best knowledge, no studies have investigated from a holistic, multi-dimensional perspective how smart contracts can change inter-

organisational relationships and resulted performance. Thus, to address this gap, we aim to investigate the relationships between smart contracting, social capital, and ensuing performance.

2.2 Social Capital

As noted, we adopt the social capital perspective to explain how relational resources and ensuing outcomes can change in the smart contracting settings. Social capital is built by being part of social activities (Putnam, 1993). It can be defined as "investment in social relations by individuals through which they gain access to embedded resources to enhance expected returns of instrumental or expressive actions" (Lin, 1999, p. 39). Indeed, prior research shows that building social capital between business partners may allow them to gain access to and leverage resources residing in the relationship (Autry & Griffis, 2008; Cousins et al., 2006). To frame our inquiry, we use the three-dimensional perspective of social capital (Nahapiet & Ghoshal, 1998). In pertinent literature, social capital is characterized by three interrelated dimensions: structural, relational, and cognitive (Nahapiet, 2009). The structural dimension includes the network of social connections between actors and the location of each actor's contacts within the network. The relational dimension emphasises the nature and the quality of relationships actors have that influence their behaviour (e.g., trust, commitment, norms). The cognitive dimension focuses on how shared representations, interpretations and systems of meaning amongst actors can yield stable connections. Although in literature these three dimensions have typically been studied independently (Lawson et al., 2008; Maurer & Ebers, 2006; Nahapiet, 2009), organisation scholars suggest that social capital dimensions are highly interrelated and play an integral part in the development of inter-organisational relationship (Krause et al., 2007; Nahapiet & Ghoshal, 1998).

3.0 Research Methods and Data

As noted above, and given the nascent nature of the phenomenon of smart contracting and the lack of related empirical literature, the methodological approach of this study comprised two phases. The aim of the first phase (Study 1) was to explore how smart contracting can influence inter-organisational social capital, which resulted in a preliminary theoretical framework. The second phase (Study 2) aimed at advancing the framework and subsequently building a process model that establishes the relationship between smart contracting, social capital, and performance.

3.1 Study 1

To initially understand the complexities of the novel phenomenon of smart contracting, the Delphi method was adopted as an exploratory tool to collect insights from international field experts who had a practical experience with the phenomenon (Linstone & Turoff, 2011; Okoli & Pawlowski, 2004). Out of 47 experts that have explicitly agreed to take part in the research, however, only 28 experts have actually participated in the study. The participants had a broad understanding of the technology, its applications, and its effects. Each expert confirmed their past or current engagement (practical experience) in projects involving or based on smart contracts.

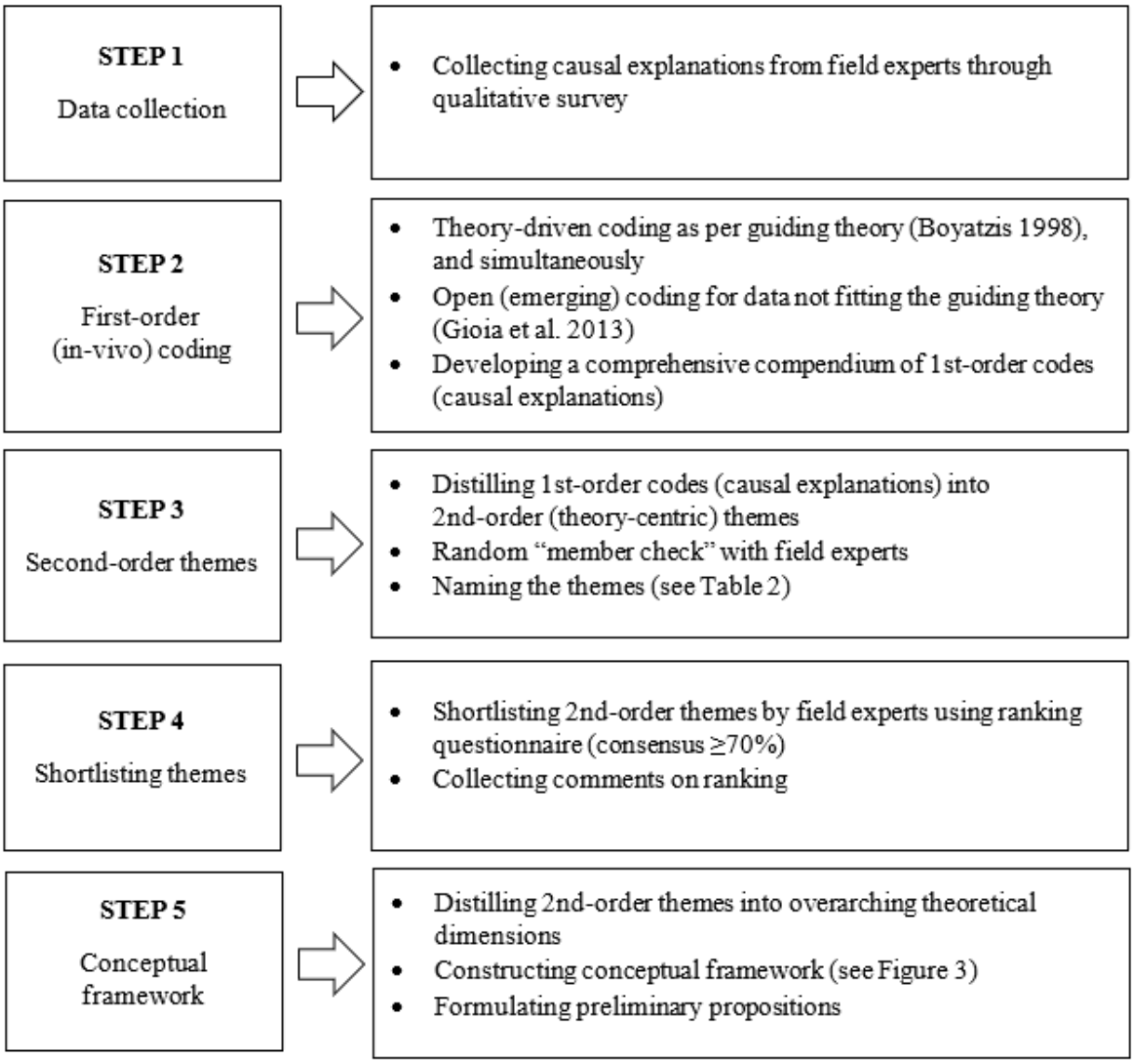

Figure 1. Data collection and analysis steps – the Delphi process (Study 1)

An exploratory focus group with three field experts was first conducted as a pilot study, results of which served as an initial and preparatory basis for the subsequent step, in which through a web-based qualitative survey, short explanations on how and why smart contracting can influence inter-organisational social capital were collected from field experts who had a practical experience with smart contracting. Figure 1 above illustrates the main steps of data collection and analysis conducted in Study 1.

Drawing on these qualitative data, a preliminary theoretical framework in the form of aggregated themes was developed. To discern themes that might constitute the basis for the theoretical description and explanation of the phenomenon under study, a more structured second-order analysis was used to view the data at a higher level of theoretical abstraction. Refining the first-order (in-vivo) codes allowed us to identify several second-order, non-overlapping dimensions or themes (Gioia et al., 2013). To these themes, theoretical labels were assigned based on a more general description that subsumed the first-order codes. In order to illustrate the transparency of how new themes inductively emerged from data, Gioia's "data structure" (Gioia et al., 2013) was adopted, see Table 2 below. Furthermore, several experts were asked to verify whether their responses (explanations) have been correctly interpreted, and verify and refine (whenever necessary) the generalisation of their explanations for each theme. This additional "member check" helped to ensure the consistency of the coding by reviewing the emergent second-order themes; thereby further enhancing and ensuring validity with the respondents.

The preliminary theoretical framework was then validated using a web-based consensus-seeking survey completed by field experts from the same sample. As suggested by Schmidt (1997), only those proposed explanations that have achieved consensus (≥70%) amongst participating experts were then used to develop themes. The shortlisted second-order themes as the most probable explanations for the proposed effects were assembled into three aggregated themes as propositions explaining the assumed relationships between smart contracting and the corresponding dimensions of inter-organisational social capital.

3.2 Study 2

The purpose of Study 2 was to utilise new empirical material to further advance our understanding about the implications of smart contracting on inter-organisational relationships and thereby refine the theoretical framework developed in Study 1. The primary data source for Study 2 was 25 semi-structured interviews conducted over six months. We interviewed highly knowledgeable, elite informants (Solarino & Aguinis, 2020) - executive decision-makers, primarily CEOs, of companies that either use smart contracts or facilitate their implementation. Sampling managerial elite was informed by methodological necessity of capturing social capital dynamics by collecting insights only from those individuals who were particularly involved in the processes of developing and maintaining relationships with partnering organisations - executives as "owners" of external social capital (Sorenson & Rogan, 2014).

Case no.	Case Type	Position	Industry	Country
1	User	CEO/Founder	Asset Management	UK
2	Facilitator	CEO	Computer Software	USA
3	Facilitator	CEO	IT Services	India
4	Facilitator	CEO/Founder	IT Services	Netherlands
5	User	Founder	E-verification	Macedonia
6	User	Partner	Insurance	Taiwan
7	User	CTO	Supply Chain	Netherlands
8	User	CEO/Founder	E-verification	Netherlands
9	User	Partner	Digital Contracting	Switzerland
10	Facilitator	CEO/Founder	IT Services	Netherlands
11	Facilitator	CEO/Founder	Computer Software	Netherlands
12	Facilitator	General Manager	IT Services	China
13	User	CEO/Founder	Supply Chain	USA
14	Facilitator	CEO/Founder	Computer Software	Switzerland
15	User	CIO	Supply Chain	Israel
16	User	COO	Supply Chain	Slovenia
17	User	CEO/Founder	Supply Chain	UK
18	Facilitator	VP	IT Services	USA
19	Facilitator	CEO/Founder	Computer Software	UK
20	Facilitator	CEO/Founder	Computer Software	Switzerland
21	User	CEO/Founder	E-Commerce	UAE
22	Facilitator	CEO/Founder	IT Services	USA
23	Facilitator	CEO/Founder	IT Services	Republic of Ireland
24	Facilitator	CFO/Founder	Consulting	Hong Kong
25	Facilitator	CEO/Founder	IT Services	UK

Table 1. Elite interview respondents (Study 2)

However, the success of gaining access to managerial elite largely depends a great deal on serendipity and social networks (McDowell, 1998; Yeung, 1995). As such, given the difficulties in gaining access to managerial elites, the limited number of smart contracting use cases and the reluctance of organisations to allow access for data collection for various reasons, this research used a snowball sampling technique (Patton, 2002; Solarino & Aguinis, 2020). The executives were initially identified through social network LinkedIn. Table 1 above lists all elite respondents interviewed for this study.

We began the interviews by asking informants background questions about their organisations and what role smart contracting plays for them. Given the nature of elite interviewing, the main interview questions were designed to be focused on interplay between technology and social processes. To enhance the accuracy of information and the robustness of the resulting theorising (Anand et al., 2007), we triangulated data sources. The data sources included interviews, e-mails and instant messaging, phone and video conversations, and archival data such as internal documents (e.g., white papers), websites, social media accounts, and news articles. The potential informant bias was addressed in the following ways. First, we gained insights from different stakeholders of the smart contracting ecosystem (users and facilitators) to triangulate informants' accounts. Second, to limit recall bias and enhance accuracy, we used semi-structured questioning of highly knowledgeable informants focused on recent and important activities (Golden, 1992). Third, we used, whenever possible, an interview approach, similar to "courtroom questioning", focusing on actual accounts of what informants or their companies did or observed others doing (Huber & Power, 1985; Lipton, 1977). Fourth, we triangulated data from multiple informants and archival sources (Kumar et al., 1993). Fifth, we promised anonymity to all our informants and their companies to encourage candour. Finally, the informants were motivated to provide accurate information because they share the lack of existing knowledge on the implications of this technology on inter-organisation relations.

To develop an understanding of the interpretations or perceptions of the actors being studied, it was necessary during the analysis to focus on explanations of the actors' actions generated inductively during data collection (see Giddens, 1979). Amongst the two inductive methodologies, the grounded theory and analytic induction, the latter was selected because it can explicitly accommodate existing theories (Johnson, 2004; P. K. Manning, 1982) and also facilitate the

identification of necessary conditions for the phenomenon to be explained (Gill & Johnson, 2002; Robinson, 1951). Analytic induction is generally understood as "the process by which a researcher moves between induction and deduction while practicing the constant comparative method" (Suddaby, 2006, p. 639).

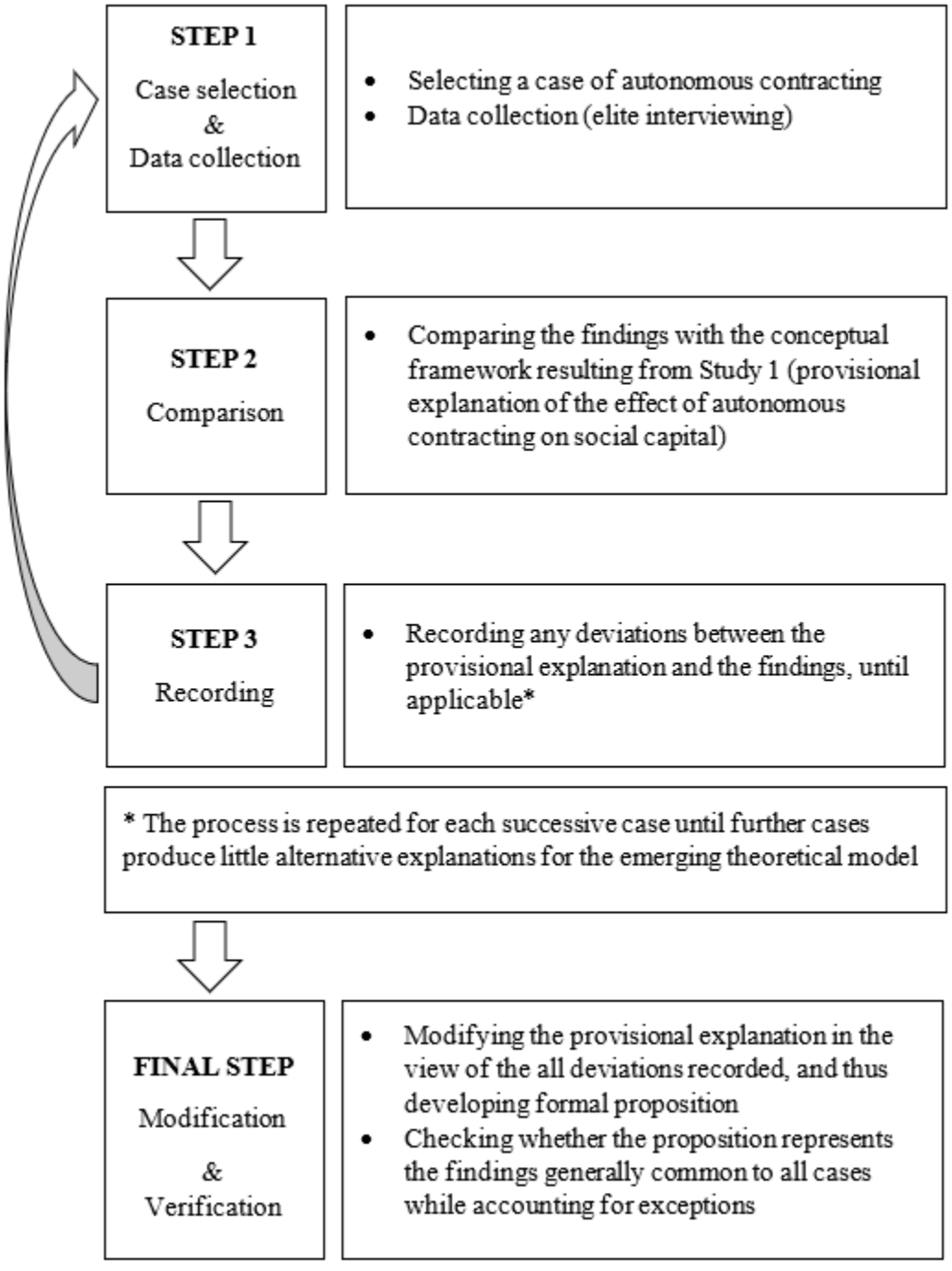

Figure 2. The process of analytic induction (Study 2)

Using an iterative process of analytic induction (Johnson, 2004; Znaniecki, 1934), the collected data were compared against the results from Study 1; the preliminary framework used a structuring platform for the analysis (see Figure 2). However, despite the versatility of this approach, its logic has an important constrain, that is, it might be unclear whether new insights deriving from the following cases are relevant to the preceding ones. In other words, it was useful to check whether the final model (propositions) represents the findings generally common to all cases while accounting for exceptions. Following Pratt, Kaplan and Whittington (2020), we adjusted the methodological approach to fit the study's objectives. Accordingly, the process of data analysis in Study 2 involved two stages. In the first stage (see steps 1 to 3 in Figure 2), the provisional propositions derived from Study 1 were comparatively analysed against the accounts given by informants (e.g., cases where executives shared their experience representing their organisation (Sorenson & Rogan, 2014)), on the *case-by-case basis*, and then, for conformity purposes, each proposition was compared against the data (all cases selected as final sample) on the *proposition-by-proposition basis*, and modified accordingly where applicable. During the second stage of the data analysis (see Final Step in Figure 2), each proposition was compared against data and either received a *direct* support when the informants provided some explanation for the effect, an *indirect* support when the informants explicitly or implicitly agreed that the effect exist but did not offer any explanation particularly supporting the proposition, or required a *reformulation* to account for disagreement or new insights provided by the informants. However, there were instances when some informants, for various reasons, were unable or avoided answering some questions. Such instances were deemed as neither supporting nor rejecting particular propositions unless explicitly stated by the informants. During this stage, the reformulated propositions related to a particular issue were aggregated into one final, comprehensive proposition that would, to a large extent, encompass the suggestions made by the informants related to the issue. In sum, the process of analytic induction not only helped to further specify and sharpen the initial propositions derived in Study 1, but also yielded new insights and propositions that were not anticipated previously. Table 3 below lists all the final propositions. The outcome is the process model that offers explanations about the effects of smart contracting on inter-organisational relations and their subsequent outcomes.

4.0 Findings

As elaborated above, this exploratory research, aiming to explain how smart contracting can affect inter-organisational relationships and ensuing outcomes, was conducted in two studies. The results of Study 1 are first described and then evaluated, justifying the necessity for further theoretical development. This is followed by Study 2's key findings. Due to space limitations, we report our findings in a relatively concise fashion (restricted in using direct quotes).

4.1 Results of Study 1

Drawing on qualitative data collected from field experts who had a practical experience with smart contracting, a preliminary theoretical framework was developed, proposing conceptual boundaries of the phenomenon. This framework (see Figure 3) includes the three overarching key themes that serve as the explanatory basis for the relationship between smart contacting and the three dimensions of inter-organisational social capital (structural, relational, and cognitive). The three themes that emerged from data (see Table 2) are: Visibility, Automation, and Special Requirements.

First order (in-vivo statements)	Second order themes	Aggregated themes
"Most smart contracts are built on transparent networks. It is the transaction transparency and the immutability of record keeping" (Expert 7) "With smart contracts you know who had what, when, how long, and what they did" (Expert 10)	Transparency, Traceability, Visibility	**Visibility**
"The blockchain acts as a shared database to provide a secure, single source of truth" (Expert 12) "[Smart contracting helps] sharing one single source of truth between multiple participants" (Expert 24)	Veracity of Information	
"Smart contracts act according to their program" (Expert 9) "Deploying smart contracts will automate exchange of goods/services & execution of agreements" (Expert 10) "Smart contracts automate approvals, calculations and other transacting activities that are prone to lag and error" (Expert 12)	Enabled Secured Autonomous Contract Execution	**Automation**
"Smart contracts limit and decrease human errors, fraud and unscheduled activity … One of the parties can't change anything without the consensus of all the parties" (Expert 1) "By removing some human aspects of execution, there are fewer opportunities for bad behaviour" (Expert 15)	Unilateral Conduct Restricted by Code	
"The current pioneering stage of adopting blockchain technology requires a certain shared mindset that helps to perceive the relation between the involved parties as special" (Expert 15)	Special Requirements for Entering into the	**Special Requirements**

"There is a blockchain and smart contract community. Organisations that are in this space working on adopting and integrating technological solutions for their own purposes but also because they want to contribute to the development and acceptance of the technology. This drives a "special" belonging between organisations" (Expert 18)	Partnership	
"Smart contracts and backbone tech like blockchain provide us with an opportunity to establish common widespread industry standards not only in shared vocabulary and language, but more importantly on data standards" (Expert 6) "Executing transactions with smart contracts require exact and shared definition of the transaction attributes between the engaged parties" (Expert 14)	Fixed Data Input Standards (Shared standards)	

Table 2. Data structure - examples of data coding (Study 1)

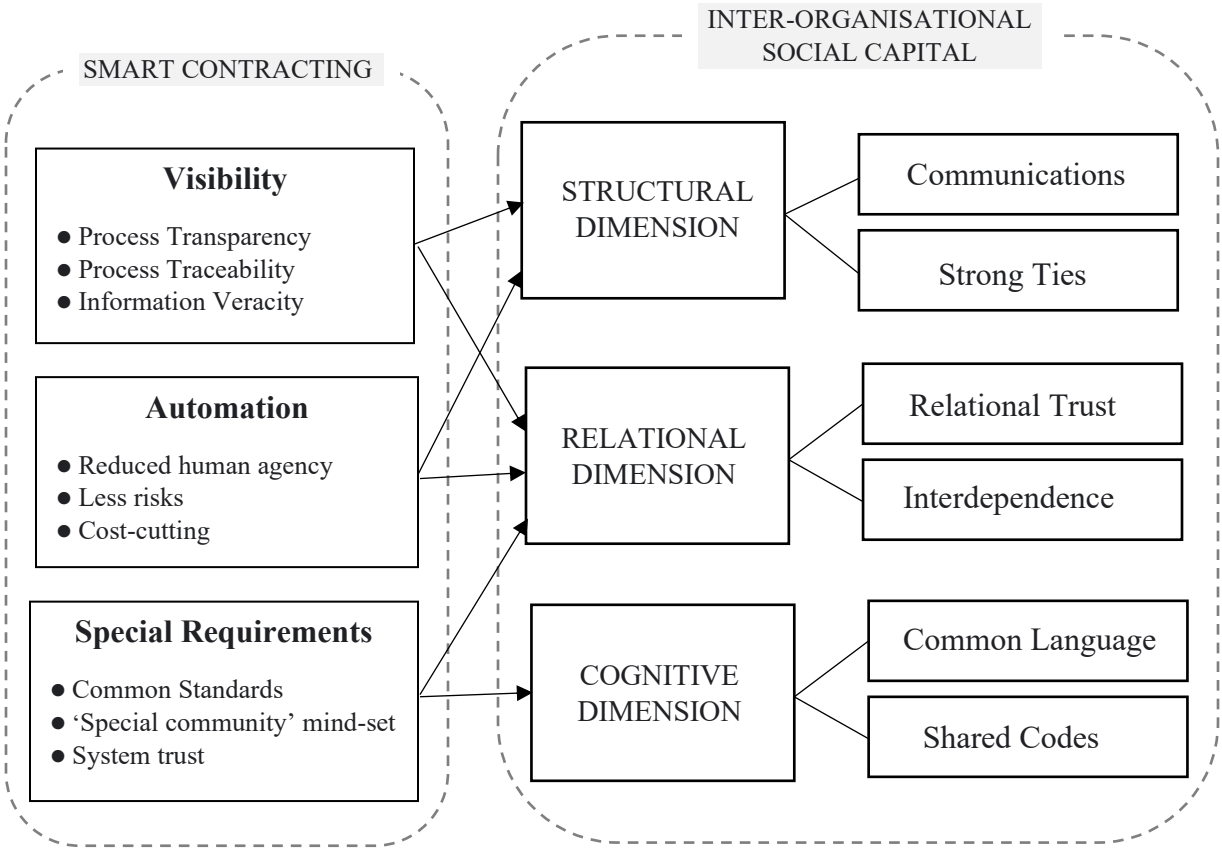

Figure 3. Theoretical framework resulted from Study 1

4.2 Evaluation of Study 1 Results

Although some of the objectives of Study 1 have been achieved, that is, to devise a preliminary theoretical framework suggesting how smart contracting influences inter-organisational social capital, due to the following explanatory deficiencies and emerged new insights, the resulting framework has thus been regarded as such that requires further theoretical development on the issue rather than a final product of the research. First, some experts argued that the algorithmic nature of smart contracting requires intensive negotiations between parties, particularly during a setting-up stage (i.e., pre-adoption stage). Therefore, it is important to understand how inter-organisational communications are affected during different stages of technology adoption in the smart contracting settings. Second, the resulting framework does not fully specify how relational trust between organisations can be affected in the smart contracting settings: increased or substituted. Field experts have emphasised the important and foundational role played by trust in the system for the formation of inter-organisational relationships compared to relational trust in the counterparty as traditionally assumed (Granovetter, 1985). The data show that in the smart contracting settings where human agency for certain activities is limited by technology, (impersonal) trust in the technological system appears to progressively substitute relational trust which has traditionally aided the conduct of social affairs. Thus, from a theoretical point of view, it is important to clarify the role of relational trust and system trust, and whether and how the former can be affected by the latter. Third, another insight that required clarification is the potential performance implications of smart contracting. Apart from general agreement on the technology-enabled (operational) performance, experts have also highlighted that smart contracting can create unique possibilities for additional value creation and innovation. To explicate the conditions for the shift from efficiency (technology-enabled coordination) to innovation (technology-enabled collaboration), more empirical data were required. Finally, from a critical point of view, apart from the insights collected from field experts, the perceptions of other players such as users of technology and vendors would widen the empirical grounding for the theoretical model, thus helping to address the above explanatory deficiencies. Therefore, to avoid theoretical speculation in the light of a relatively limited explanatory material and taking into account the emerged insights, the Study 1 framework required further conceptualisation, refinement, and validation using additional empirical data, necessitating the additional study, Study 2, the results of which are discussed next.

4.3 Results of Study 2

Following from the results of Study 1, this subsequent stage aimed to evaluate and advance the preliminary theoretical framework comprising provisional propositions. To evaluate the validity of these propositions and refine them, a new set of empirical data was iteratively compared against them using the process of analytic induction. As elaborated above, the logic of analytic induction was complemented by an additional step – the model was checked against data in a proposition-by-proposition manner – because of space limitations, we report only the final revision of the model. Although most provisional propositions found support in general, some of them required reformulations, whereas few were rejected. Table 3 lists the final propositions resulted from Study 2 along with illustrative quotes.

Final Proposition		Illustrative Quotes
1a	*In the smart contracting settings, the increased visibility of business processes will increase communications between organisations (i.e., structural social capital) during the pre-adoption stage of technology implementation, but during the post-adoption stage the communications will be reduced*	"Establishing a blockchain network requires collaboration …So during that exercise, of course, you need to have a lot of interaction between different organisations and both stakeholders involved, but if that has been completed, and the network is operating, then the necessity to physically meet each other is of course less" (Case 4)
1b	*In the smart contracting settings, the increased visibility of business processes will promote strong ties between organisations (i.e., structural social capital)*	"[The relationship] gets closer and closer. One area we have seen some clients have this in the area about supply chain financing. A very common example is Company XXX, [which] is trying to do something in the space, so XXX is really tightening that supply chain by putting it on a blockchain with smart contracts so to track movement of goods, to place orders, track the goods moving, make the payments faster. In order to take full advantage of the technologies, XXX and its suppliers have signing on to join the syndicate commitment to it. That's creating a stronger linkage and bondage between them" (Case 22)
2b	*In the smart contracting settings, the increased visibility of business processes will promote the perception of interdependence between organisations (i.e., relational social capital)*	"The new way of interaction, it's digitalized and according to the agreement of the whole supply chain, which makes it very different, because they interact now based not on their own information but based on the transparent ledger and agreement that they all agreed on, that's the main difference" (Case 7)
3a	*In the smart contracting settings, the automation of business processes will increase communications between organisations (i.e., structural social capital) during the pre-adoption stage of technology implementation, but during the post-adoption stage the communications will be reduced*	"Usually paper-based contracts tend to increase interactions at the very end of the dealing phase, so when you're in the very phase of creating a contract to address some kind of relationship. The adoption of smart contracts, especially now that we are at the early stage of that, requires much more interactions and communications in order to prepare the infrastructure and the environment" (Case 9)

3b	*In the smart contracting settings, the automation of business processes will promote strong ties between organisations (i.e., structural social capital)*	"I think that you are more connected because you share the same goal and you will interact with one smart contract, in this case, that's why you will be more connected because you are bound to a smart contract" (Case 5)
4b	*In the smart contracting settings, the automation of business processes will promote the perception of interdependence between organisations (i.e., relational social capital)*	"You are becoming more dependent on each other to accept changes, because if one party doesn't join or doesn't accept the changes, basically it's going to basically stop everything … That party should be taken out of the chain of trust basically, but then the whole thing stops, so you need to join in order to make it efficient" (Case 10)
5	*System trust (as trust in the technological system) will (a) act as a precondition to the formation of inter-organisational relations during the pre-adoption stage, and during the post-adoption stage it will (b) substitute relational trust between organisations and institution-based trust and (c) moderate the relationship between inter-organisational social capital and innovation performance*	"The willingness to participate in the smart contract ecosystem could become a differentiator or an influencing characteristic in which suppliers I choose; if a business doesn't want to engage in the ecosystem because of whatever reason, then I may choose not to work with them" (Case 18) "… once you have the ability to share data in a secure fashion and it's trustworthy, this opens up an opportunity … for the creation of new business ecosystem because you now have the opportunity to create business efficiencies and solutions that draw together competitors" (Case 18)
6a	*In the smart contracting settings, the requirement for common data standards will positively contribute to the development of common language and shared codes between organisations (i.e., cognitive social capital)*	"… the smart contracts and the clear terminology within the smart contracts as they become stronger and more crisp and clearer will actually unify the language because people will be using that language across, because if you're reliant on smart contracts then you're using the language of that reliance" (Case 21)
6b	*In the smart contracting settings, the requirement for the 'special community' mind-set will positively contribute to the development of shared codes between organisations (i.e., cognitive social capital)*	"Today if you are talking how blockchain is implemented, how people perceive themselves, if you put blockchain in front of something, you will be perceived as something special, something innovative" (Case 15)
7a	*Smart contracting will enhance operational performance by reducing operation costs (e.g., communication and labour costs) and/or transaction costs (e.g., governance costs)*	"The smart contracts are providing automation to a certain degree now. This automation is helping us reduce our labour costs associated particularly in doing these operations. One is definitely cost reduction, that is important … It is bringing down the costs associated with operations" (Case 3)
7b	*In the autonomous contracting settings, the enhanced operational performance will moderate the relationship between inter-organisational social capital and innovation performance*	"It's always a question of creating an efficient system. When you ever remove inefficiency in areas of the business which are completely automated now, you can recover that work and use it for instance for business development instead of using resources to make low-level activities" (Case 24)
7c	*Smart contracting will further strengthen system trust during the post-adoption stage*	"By using this platform, this cost will come down a lot and quite significantly. Both the parties are quite happy to work in this kind of scenario where they are both bound by a smart contract and they don't have to trust anyone else to clear their settlements" (Case 6)
8	*In the smart contracting settings, inter-organisational social capital will facilitate innovation performance during the post-adoption stage*	"It is a stepping stone for doing that. Because if you are embracing technology where you're all dependent of, then there is a stepping stone to communicate about innovation together" (Case 10)
9	*Existing strategic goals and/or managerial discretion will moderate the relationship*	"It could be that the time that is left is used for streamlining other business processes. That's a positive development. A negative development could be that a company starts sitting

	between inter-organisational social capital and innovation performance	back [and] thinking: "Well, everything's arranged. Everything's working with a smart contract." There are always two sides to the coin" (Case 11)

Table 3. Final propositions and illustrative quotes supporting them

Figure 3 below integrates the findings of this research regarding the effects of smart contracting on inter-organisational relationships, ensuing performance implications, and related contingencies. The (numbered) arrows in the figure below reflect the corresponding propositions for the direct and moderating effects listed above in Table 3.

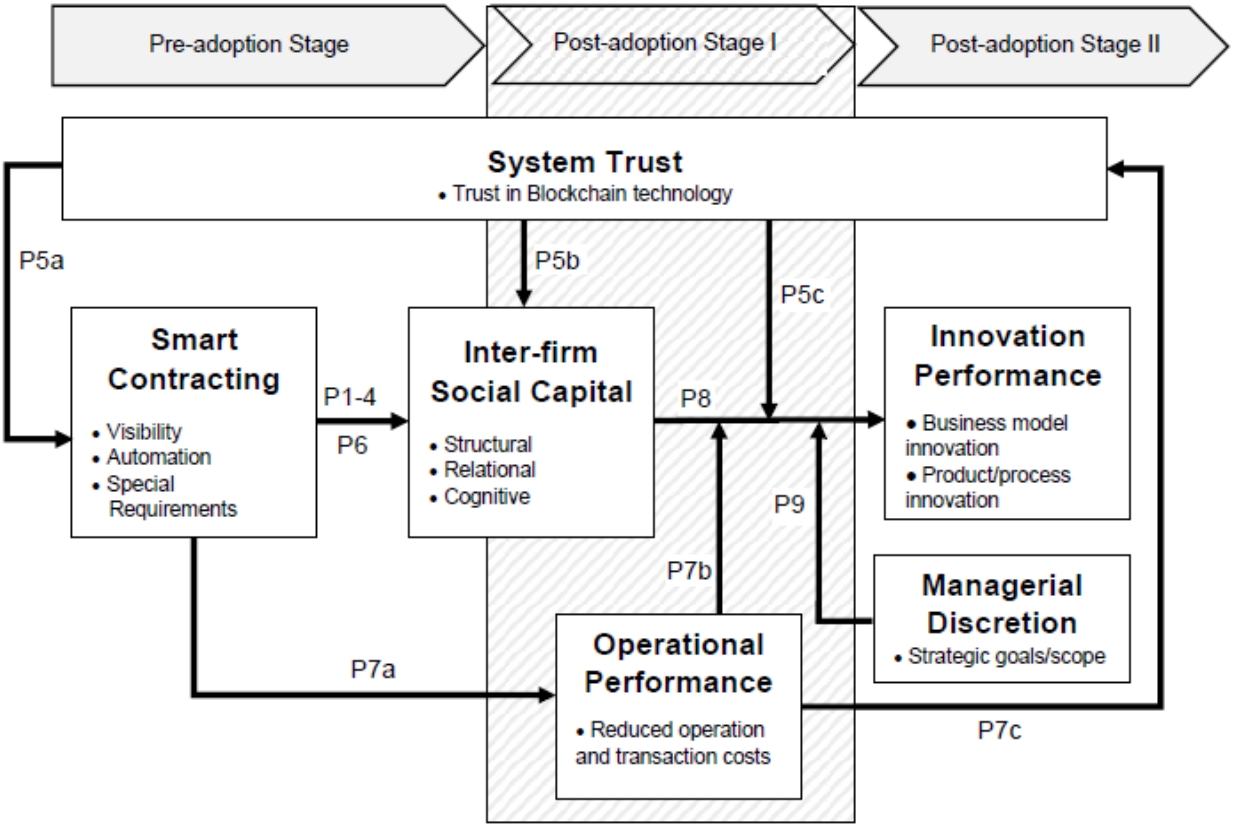

Figure 3. The process model of Blockchain-based inter-organisational relationships

The process model, as depicted in Figure 3, illustrates the evolutionary process of inter-organisational relationships, which starts at the pre-adoption stage where parties collaborate on establishing smart contracting and thus develop inter-organisational social capital as a by-product of this collaboration, and subsequently progresses to the post-adoption stage which is characterised by the actual application of smart contracting and, as data show, can be divided into two phases

differentiated by outcomes. A typical result of the first phase is operational performance reflected by the reduction of operation and transaction costs, while a potential outcome of the second is innovation performance which may include, for instance, business model innovation or product/process innovation.

The collected data suggest a direct, positive relationship between smart contracting and inter-organisational social capital developed at the pre-adoption stage. Through the enhanced visibility and automation of business processes along with special requirements for parties, smart contracting facilitates the development of all three dimensions of social capital: structural, relational, and cognitive. It was however found that both the formation dynamics and structure of social capital in the settings where contracts are executed autonomously by technology are different form the traditional contractual arrangements. These differences are largely driven by system trust as an underlying normative foundation specific to the technology-based arrangements. System trust can be defined *as trust that organisations put in the proper functioning of autonomous technological systems specifically used to facilitate an economic exchange with other organisations in the conditions when building relational trust and rely on institution-based trust is either inefficient, unnecessary, or impossible*. It is found to be a pre-condition to the formation of such arrangements, facilitating the rapidity of social capital formation during the pre-adoption stage of smart contracting implementation. The pre-adoption stage process includes the initial interactions between prospective partners towards setting up an autonomous contract as an efficient alternative to traditional means of inter-organisational governance. In seeking to reduce operation and transaction costs, those organisations that perceive both relational trust and existing institutions as inefficient mechanisms in facilitating economic transactions retreat to instead rely on technology-based mechanisms such as blockchain-based smart contracting. In this sense, preliminary trusting the proper functioning of autonomous technological systems, hence system trust, becomes a necessary pre-condition to the formation of inter-organisational relationships. In addition to this condition, common data standards and ‘special community’ mind-set are seen as special, though relatively less important, requirements for prospective partners to join the relationship. When at least system trust is present at the pre-adoption stage, organisations engage in the process of establishing smart contracting through intensive negotiations and collaborations. Data show that, due to the algorithmic nature of smart contracting, interactions amongst parties during this stage are more active and intensive compared to the setting up of a traditional

contracting. Accordingly, the formation of inter-organisational social capital during this stage, and particularly its structural dimension, is assumed to be more dynamic than in the traditional settings. Smart contracting drives the development of intensive communication patterns and the formation of strong ties between organisations.

The post-adoption stage, as noted above, can comprise two subsequent phases. In the first, as found in all cases, smart contracting improves operational efficiency by reducing operation and transaction costs. Such an achievement of satisfactory operational performance for some organisations is seen as the main and final intent. Yet, under certain conditions, inter-organisational relationships can progress up to the second phase of the post-adoption stage, resulting in innovation performance. Reaching this phase is however more contingent. It was found that the positive relationship between social capital and innovation performance is moderated by the achievement of operational performance, system trust, and managerial discretion. In this regard, smart contracting, by reducing some operation and transaction costs, enhances operational performance which, in turn, moderates the relationship between social capital and innovation performance and exerts a positive feedback effect on system trust. In this stage, the achievement of operational performance induces parties to interact to further implement the technology for (additional) mutual benefits, thereby enhancing the development of structural social capital between parties. In this sense, as data show, the increased operational performance acts as a gateway to innovation activities, endogenously supporting the positive association between social capital and innovation performance.

The achievement of operational performance is also found to strengthen system trust that endogenously affects the relationship between social capital and innovation performance. As mentioned, system trust is perceived by parties as an underlying foundation on which the inter-organisational relationships are built and dependent. In the post-adoption stage, system trust is found to be a key contextual factor that substitutes both relational and institution-based trust traditionally used in the inter-organisational governance apparatus, thereby altering the structure of inter-organisational social capital, particularly its relational dimension (e.g., substituting relational trust). This implies the contextual influence of system trust on most, if not all, of the inter-organisational processes executed in the smart contracting settings. Finally, data suggest that the managerial discretion also plays an important role in the achievement of innovation

performance. When the emerged innovations opportunities do not fit with parties' existing strategies or fall out of the scope of business, the prediction for this performance is less straightforward and seems to depend on the discretion of decision-makers.

5.0 Discussion

With this research, we offer several core contributions for the studies investigating the implications of digital transformation, but specifically exploring how information systems and information technologies can help in enabling innovation and creativity in various contexts (Kitsios & Kamariotou, 2021; Saldanha et al., 2020).

First, by discerning stages of the technology implementation, this research shows that the performance implications during the post-adoption stage, which is divided into two phases, are different. A typical result of the first phase is operational performance reflected by the reduction of operation and transaction costs while a potential outcome of the second phase is innovation performance which may include, for instance, business model innovation or product/process innovation. Although the resulting operational performance in the smart contracting settings is also found by some other studies (e.g., S. E. Chang et al., 2019; Cucari et al., 2021; Roeck et al., 2020), innovation outcome as performance implication appears as a novel empirical finding in the blockchain literature. While some prior studies theoretically anticipated innovation as outcome of blockchain technology implementation (Chong et al., 2019; Maull et al., 2017; Mukherjee et al., 2021; Tiscini et al., 2020), this research identified that under certain conditions smart contracting can facilitate the process of interaction and integration of resources between organisations during the second phase of the post-adoption stage (collaboration), resulting in innovation outcomes. Data reveal that inter-organisational social capital developed in the autonomous contracting settings can act as an important driver for the innovation performance during the second phase of the post-adoption stage.

This finding echoes extant research arguing that, in the traditional settings, social capital by creating a psychological environment conducive to collaboration and mutual support is likely to facilitate cooperative behaviours amongst parties (e.g. Al-Tabbaa & Ankrah, 2016; Baker, 1990; Eberly et al., 2011; Kale et al., 2000; Nahapiet, 2009; Ring & Van Der Ven, 1994), often resulting

in value co-creation as proxy for innovation (Autry & Griffis, 2008; Dyer et al., 2018; Tsai & Ghoshal, 1998; Vlaar, 2008). However, given that social capital is a context-dependent phenomenon (Nahapiet & Ghoshal, 1998; Putnam, 1993), its formational dynamics and configuration depend on the context in which it develops. Indeed, this research shows that inter-organisational social capital developed in the smart contracting settings is qualitatively different from one built in the traditional arrangements. It is driven by unique features of smart contracting such as automation and enhanced visibility; can be built relatively quicker; and depends on system trust rather than on relational trust as traditionally conceived. This differentiation implies that technology-driven mechanisms are mostly at play in this context and that the link between social capital and innovation outcomes should be revisited in the light of pervasive algorithmic technologies and their increasing mediating role in the social structure of business relationships, making it ultimately less social.

Second, and relatedly, while prior studies (Batjargal, 2003; Larson, 1992; Maurer & Ebers, 2006; Stam et al., 2014) largely support the positive link between social capital and firm performance, in the smart contracting settings the positive relationship between social capital and innovation performance is influenced by the achievement of operational performance, system trust, and managerial discretion, as depicted in Figure 3. The achievement of operational performance induces parties to interact more to further implement the technology for (additional) mutual benefits. In line with prior research (Caldarelli et al., 2021), extensive communications with partners is required for successful implementation of blockchain technology. Also, due to automation of some processes, more cognitive and human resources are released thereby enhancing the quality of innovation-focused interactions shifting them from operational to strategic level conversations. System trust is perceived by parties as an underlying foundation on which the inter-organisational relationships are built and dependent. As such, the engagement in innovation-focused collaborations appears to be moderated by system trust. Likewise, managerial discretion is another factor that can attenuate the relationship between social capital and innovation performance, depending on the strategic goals or the scope of business. These critical factors are found as important in explaining innovation outcome in the autonomous contracting settings. While future empirical studies can assess the relevance of these identified factors, they may also strive to find other factors affecting, positively or negatively, innovation performance in this context.

Finally, unlike prior research argues (e.g. Das & Teng, 2002), the collected data illustrate that in the smart contracting settings interdependency facilitates value co-creation (as proxy for innovation), thereby corroborates the opposite perspective (e.g. Ren et al., 2015). By adopting smart contracting for inter-organisational exchanges, partners become largely dependent on each other. In Thompson's (1967) terms, this represents a sequential interdependence, which requires higher levels of inter-organisational coordination as the output of one partner is, in fact, the input to the other. However, along with a technology-enabled interdependency, smart contracting requires parties to develop specific but common cognitive frames, facilitating value co-creation. Data show that firms that implement smart contracting appear to depart from traditional views on the evolution of inter-organisational cooperation and are shaped by novel cognitive frames that need to be adopted in order to effectively implement the technology. These frames facilitate strategic conversations between partners by easing information and knowledge exchange. While this finding echoes prior research (Balogun & Johnson, 2004; Ring & Van Der Ven, 1994; Vlaar, 2008) arguing that contracting amplify value creation through developing more congruent and advanced understandings amongst parties, the autonomous nature of smart contracting, in contrast to traditional arrangements, implies conceptually different mechanisms that drive collaboration. In these novel arrangements, a strong perception of interdependence between parties is underpinned by rigid technology-based consensus mechanisms that increasingly limit parties' ability to act unilaterally but rather force them to seek consensus. Bounded by such rigid but highly certain arrangements, organisations appear to be destined to form strong ties and common future. Such state of affairs is found to be conducive for the development of strong ties between organisations in the smart contracting settings underpinned by technology-enabled automation and visibility of business processes rather than traditionally by reciprocity and relational trust. In these settings, however, the nature of interfirm ties seems to change, that is, social ties progressively become "digital ties" (Brescia, 2018). This development transforms the boundary conditions of this (now) digital environment and, particularly, behaviour of actors within it. These findings support recent theoretical assumptions by illustrating that, indeed, smart contracts "*enable original social behaviors and innovative exchange patterns*" (Lumineau et al., 2021, p. 516). These new patterns emerge in the context of autonomous technology which becomes increasingly pervasive in the contemporary business practice (Deloitte, 2020; Rauchs et al., 2019), respectively inviting innovation scholars to update our knowledge on the role autonomous technologies in shaping

innovation-related behaviours of firms. This finding thus adds to the studies on interfirm value creation (e.g., Bengtsson et al., 2016; Storbacka et al., 2016), offering novel, technology-driven dynamics underlying creation of value. Yet, while such dynamics might be context-specific, this result points to a different perspective on the antecedents of value co-creation in the technology-dependent context, presenting fruitful research opportunities for contemporary management scholarship.

With regard to practical contributions (Banks, Barnes, & Jiang, 2021), our findings illustrate that the emerging phenomenon of automation, evident in smart contracting, contributes to the global trend when some inter-organizational business processes that previously involved human actors are increasingly being substituted by technology (Alaimo & Kallinikos, 2020; Kellogg et al., 2020). What once seen as a necessity for effective collaborations between organizations, such as face-to-face interactions and interpersonal trust (Barringer & Harrison, 2000; Cropanzano & Mitchell, 2005), nowadays appears to gradually lose its importance. Instead, a vicious circle of interpersonal distrust institutionalized by algorithmic technologies seems to prevail. For decision-makers, smart contracting will not only promise enhanced efficiency, but also novel challenges. The ability to co-create value with partners will mostly depend on the effective management of data exchanged through the technology-based system and whether that can translate into innovation opportunities. All this will require a more thoughtful and detailed ex-ante (pre-adoption) planning compared to traditional approaches. Considerations about what data should be transparent and how it can collectively be explored and exploited will have a decisive effect. In order to break out from transactional relationships induced by algorithmic technologies and promote relational trust, contemporary managers need to integrate in their implementation strategies the traditional means by which relational resources (interpersonal trust, reciprocity and common values) can be built and sustained to complement impersonal mechanisms in seeking new value.

6.0 Limitations & Future Research

Despite the contributions that this research makes to both theory and practice, it has several methodological limitations that should be seen as opportunities for future researchers to consider these imperfections and thereby further advance our knowledge on this emerging topic area.

First, although the breadth of data gathered from the key participants of the smart contracting ecosystem allowed the researchers to triangulate across the entire corpus and thematically identify the key factors influencing inter-organisational relationships in these novel settings, the depth of collected data might be considered as relatively low compared to the case study approach, for example. Arguably for this reason, this research does not mean to be exhaustive in terms of presenting a comprehensive theoretical model, but to offer a first fresh view on this autonomous technology that seems to have the necessary characteristics to significantly challenge the dominant approach to the management of inter-organisational relationships. In this regard, while the trade-off between the breadth and the depth of collected data is still relevant, future studies may contribute to the findings of this research by conducting in-depth case studies, provided they can ensure a complete access to data.

Second, the outcome of this exploratory research is the process model illustrating the evolutionary process of inter-organisational relationships in the smart contracting settings. However, it should be noted that this research captured data at a single point in time. Working in the context of an emerging phenomenon, the researchers were limited by restricted access to use cases and consequently bounded to use retrospective interview questions with executives in order to elicit the evolutionary dynamics of inter-firm relations. This suggests that the sequential relationship between all the factors in the process model developed in this research might not have been fully captured (Gehman *et al.* 2018; Langley 1999). Against this backdrop, future studies should specifically address the process issue; the use of longitudinal case studies would allow to observe how inter-organisational relationships in the autonomous contracting settings evolve over time in more detail. In addition, action research and ethnographic studies would provide longitudinal data as well as valuable "insider's view" on the (inter)organisational social processes related to the BCT implementation.

Furthermore, future research should begin to give more attention to the social implications of algorithmic technologies, expanding our understanding of technology-based business value beyond economic dimensions. Following this study's findings, researchers can further explore whether less time required for the formation of inter-organizational social capital in the relationships mediated by algorithmic technologies, or evaluate the foundational role of the cognitive dimension for the initial development of both the structural and relational dimensions of

inter-organizational social capital. As this study has found some support for a technology-related identification or rather bias that acts for parties as a getaway or precondition to form effective business relationship, it would be interesting for future studies to critically investigate the relationship between technology-related identification and social capital in the technology-dependent contexts. It is also important to explore the role that relational trust plays in the technology-dependent business contexts, as well the relationship between system-based trust and relational trust. Future studies should also pay a particular attention to the antecedents to and the effects of system trust, as trust in the technology, if we strive to produce adequate knowledge reflecting the true state of affairs in the contemporary business environment. This (new) type of trust should thus be considered as an additional variable for the models reflecting the relationships between social and technological influences concerning how we understand technology-based inter-organizational relations.

7.0 Conclusion

This study represents one of the first empirical contribution regarding the role of smart (autonomous) contracting in the formation and evolution of inter-organisational relationships. The adopted social capital perspective has offered a way to study the relationships between social and technological influences concerning how we understand technology-based inter-organisational relations. In particular, it has helped to systematically investigate the influence of blockchain-based smart contracting on the key social dimensions of inter-organisational relations and aided to explain innovation performance beyond operational gains. Our findings revealed that smart contracting directly affects the formation and structure of inter-organisational social capital, which can subsequently contribute to innovation performance. It appears that less time required for the formation of inter-organisational social capital and that relational trust plays less significant role for technology-based inter-organisational relations. We also developed an evidence-based model that critically integrates factors influencing the relationship between social capital and innovation performance. Interestingly, system trust, as trust in technology, is found to be the key contextual factor, driving most aspects of inter-organisational collaborations. Our study is amongst the first that have conceptualised and provided empirical support for the notion of a truly impersonal system trust, showing that non-social entities such as smart contracting can be a means of reassurance for mobilising truly impersonal trust at the inter-organisation level. System trust

changes the context in which inter-organisational social capital forms and develops, and subsequently contributes to innovation performance in technology-based partnerships.

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